For entrants in AY 2022

Appended Form 1

Specifications for Major Program

Name of School (Program)〔School of Engineering Cluster 2(Electrical, Electronic and Systems Engineering)〕

Program name (Japanese)	電子システムプログラム
(English)	Program of Electronic Devices and Systems

1.Academic Degree to be Acquired：Bachelor's degree in engineering

2. Overview

In the fields of electricity, electronics, systems, information, and in other related fields, technological innovation has been advancing rapidly. We are now in a situation where innovative technology, ideas, and theories are being produced not only by deepening expert knowledge in a specific area, but by combining expert knowledge from multiple fields. As the impact of such technology on society is getting greater, it is always necessary to keep in mind the relationship between humankind, society, and nature.

On the basis of these social trends, Cluster 2 in the School of Engineering (electricity, electronics, systems, and information) has prepared the following programs with the aim of developing professionals who have a wide range of perspectives and insights, a sense of responsibility, and an ethical outlook, as well as specialized technological, problem-analyzing, and problem-solving abilities.

・The Program of Electronic Devices and Systems

・The Program of Electrical Systems and Information Engineering

Except for in exceptional circumstances, students who are enrolled in Cluster 2 in the School of Engineering (Electrical, Electronic and Systems Engineering) can choose this program from the above two options at the start of the second year, after going through liberal arts education and specialized education for one year after enrollment.

In the Program of Electronic Devices and Systems, students study electronic engineering centering on semiconductor devices such as integrated circuits.

Semiconductor device technology is one of the central technologies that supports modern society, in which computerization and informatization have been advancing. Today we use a number of devices and types of equipment in daily life and at work, such as audio and video equipment (TVs, video players, etc.) information processing and communication equipment (computers, the internet, mobile phones, etc.), transportation equipment (automobiles), electric home appliances (cooking devices, etc.), medical equipment, manufacturing equipment used in factories, etc., most of which is capable of complicated processing through simple operations using semiconductor devices. In medical and nursing care equipment, and in robots working at disaster sites, which are expected to become increasingly important in the years to come, operability that can achieve complex movement is more necessary than ever. Therefore, the ability to detect the situation using high performance and high functioning sensors, together with complex information processing using integrated circuits, is indispensable. Furthermore, the realization of judgment processing using artificial intelligence is eagerly awaited.

Meanwhile, considering the energy issues and global environmental problems that are expected to become serious in the future, electronic engineering technology centering on semiconductor devices has a major role to play in resolving many challenges. In order to reduce wasteful energy consumption by the efficient operation of various equipment, the utilization of semiconductor devices, not least solar cells, which are semiconductor devices that generate energy, is absolutely necessary.

Needless to say, new technology to reduce energy consumption by semiconductor devices themselves is also necessary.

To respond to such needs, it is necessary to refine current semiconductor technology through the introduction of new materials and new operating principles, and to develop technology that incorporates other fields. In order to develop professionals who have systematic knowledge and the ability to develop innovative technology, and who

can play a central role in solving such challenges, this program offers a curriculum in which students can learn systematically and extensively, from basic knowledge such as quantum physics and basic semiconductor physics, to the latest research such as high performance electronic devices in nanometer size and high-functioning integrated circuit systems.

The following are the characteristics of the Program of Electronic Devices and Systems.

(1) Class subjects are arranged to make it possible for students to learn in order the subjects related to each of the fields, physics and materials, semiconductor devices, and integrated systems. Class subjects are also arranged so that the association of subjects in each field is taken into consideration.

(2) Entry-level subjects and introductory subjects in each field (Introduction to Physical Electronics, Introduction to Semiconductor Devices and Circuits) have been prepared for the second year. Consideration has been given to ensuring that students can see the whole picture in the specialized subject groups that they study. On the other hand, a variety of specialized subjects, including the most advanced science and technology, are offered in the second semester of the third year.

(3) Subjects concerning physics and solid state physics, which form basis of materials and semiconductor devices, have been designed so that students can learn the basic principles necessary for innovative technological development. Students can also systematically learn the design engineering of integrated circuits from the basics of electrical and electronic circuits to the latest integrated circuits.

(4) This program focuses on acquisition of knowledge, and technical and research ability, in relation to actual “things” such as materials, devices, and integrated circuits. For graduation work, subjects pertinent to the latest research have been set, such as the manufacture of functional materials, the evaluation of physical properties, the manufacture of new functional devices and semiconductor devices in nanometer size, algorithms utilizable in actual systems, and the design and prototype of integrated circuits.

(5) In collaboration with other programs, students can learn subjects concerning electric energy, electronic control, signal processing, and software.

3. Academic Awards Policy (Goals of the Program and Policy for Awarding Degrees)

The Program of Electronic Devices and Systems offers an education that emphasizes the field of physical properties and materials, which forms the basis for new devices, the field of high performance semiconductor devices in nanometer size, and the field of integrated systems, centering on high performance integrated circuits. By providing both the basic concepts and cutting edge knowledge in each field, and by identifying the mutual relationships between the fields in a systematic manner, this program aims at developing professionals who can take the lead in engineering development in the electronic engineering field and who have the ability to develop innovative technology by fusing together the different fields, which will be of growing importance in the future.

Specifically, this program offers education aimed at cultivating a broad range of general knowledge, an international perspective which aspires to peace, a general sense of judgment, and a well-rounded character.

The program awards a bachelor’s degree in engineering to students who, in addition to the number of credits necessary to meet the standard of the course, have acquired the liberal arts education and specialized education necessary to prepare them for achieving the following goals:

【Goal A】Acquisition of the ability to recognize the relationship between science and technology, and humankind, society, and the natural environment, from various perspectives, and the ability to understand the responsibilities engineers have for society.

【Goal B】 Acquisition of the basic knowledge commonly required in the field of electronic systems and the abilities applicable to the field.

【Goal C】 Acquisition of the ability to analyze given challenges by using expertise, and draw solutions that meet the requirements of society.

【Goal D】 Acquisition of the ability to draw up plans and measures to resolve challenges, and the will to carry these measures out.

【Goal E】Acquisition of the ability to gather information and to communicate in Japanese and English. Acquisition of the ability to sum up one's thoughts and accomplishments, to write logically, and to give a presentation.

4.Curriculum Policy

・The ability to take an approach to solving various problems after understanding that such problems that exist in humankind, society, and among individuals can be interpreted in various ways depending on social conditions, cultures, etc. (Goal A, D). This is obtained through mastery of liberal arts education subjects such as “Basic Language I” and “Area Courses”.

・The ability to read, write, converse, and retrieve information in the English language necessary for conducting research (Goal E). This is obtained through mastery of “Technical English” to be offered in the third year and “Graduation Thesis“ to be offered in the fourth year.

5. Program Timing and Acceptance Conditions

At the beginning of the second year, students are assigned to this program based on consideration of their request and academic results. In order to be assigned to this program, students must acquire a total of 34 or more credits in liberal arts education subjects and specialized education subjects by the end of the first year.

6. Qualifications to be Acquired

By mastering the predetermined courses, students can obtain Type-1 High School Teaching License (Industry). Besides that, by mastering the predetermined class subjects, students are exempted from the examination subjects of the national exams for electrical chief engineers, chief telecommunications engineers and technical radio operators. The details are given in student handbook.

7. Class subjects and course content

* For class subjects, see the course list table on the attached sheet.
* For course content, see the syllabus for each academic year.

8. Academic Achievements

At the end of each semester, the evaluation criteria are applied to each evaluation item of academic achievement to clearly demonstrate the level of attainment. Students’ grade calculation for each subject from admission to the current semester is given in one of three levels: “Excellent,” “Very Good,” and “Good,” based on evaluation criteria calculated by adding the weighted values to the numerically-converted values of their academic achievements (S = 4, A = 3, B = 2, and C= 1) in each subject being evaluated.

Academic achievement	Evaluation criteria
Excellent	

* See the relationship between evaluation items and evaluation criteria in the attached sheet 2.
* See the relationship between evaluation items and class subjects in the attached sheet 3.
* See the curriculum map in the attached sheet 4.

10. Responsibility System

(1) PDCA Responsibility System (“Plan,” “Do,” “Check,” and “Act”)

This program is operated by teachers who support the Program of Electronic Devices and Systems, however, the program targets students who belong to Cluster 2 and, therefore, the person responsible for executing the program is the Cluster 2 leader. Planning, implementing, evaluation, and handling are discussed mainly in the Cluster 2 Education Program committee and in the Cluster 2 committee (held, in principle, on the first Wednesday of every month) in an appropriate manner. Depending on the situation or content, a working group is established at the instruction of the Cluster leader to focus in the issues at hand.

When there is a need to consider the response on a program basis, research laboratory groups responsible for the applicable program take the necessary measures. In that case, the responsible person is appointed by the Cluster leader.

(2) Program assessment

○ Criteria for Program assessment

- Whether or not each class subject is properly allocated in light of the goals of the program, and whether course content is appropriate
- Whether or not students taking the course have one average achieved the goal or above
- Whether or not the system runs in proper cycles that enable the program to continually improve in an upward spiral

○ How it is assessed

- Conducting self-assessment for each subject based on the results of class evaluations carried out by students who have taken the course, and also based on grade calculation results
- Regarding the upward spiral of the program, obtaining the questionnaire from graduates in suitable cycles and also collecting the needs from business corporations

○ Position on giving feedback to students and how it is approached

- For individual courses, the teacher in charge gives comments on course evaluation results and academic achievement results.
- For re-examining the program structure, the reasons for and the purposes of re-examination are given on the website.

Cluster 2　Electrical, Electronic and Systems Engineering

Required subject (period of registration specified)
○ Compulsory elective subject (any of these subjects shall be registered)
Free elective subject (any of these subjects shall be registered)

Subject Type	Required No. of credits	Class subjects, etc.	No. of credits	Type of course registration	Year in which the srihbj h t6 (i)5.5 ÷8.1 ikC 5 (uin5(r)E(*T)-8.4 (he l-8 (toi)5.5 (													
					Spring								Spring		Fall			
					1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T
Peace science curse	2		2	Compulsory elective		○														
	2	Introduction to University Education	2	Required																
	2	Introductory Seminar for First-Year Students	2	Required																
Area Courses	4	Courses in Arts and Humanities/Social Sciences	2	Compulsory elective	○		○													
	4	Courses in Natural Sciences	2			○		○												
Communication		Basic English UsageI	1																	
		Basic English UsageII	1																	
		CommunicationI	1																	
		Communication I	1																	
		Communication II	1																	
		Communication II	1																	
		1 subjects from Basic language I	1																	
		1 subjects from Basic language II	1			◯														
	2	Introduction to Information and Data Sciencies	2	Required																
	2		1or2	Compulsory elective	○	○	○	○												
		CalculusI	2																	
		CalculusII	2																	
		Linear AlgebraI	2																	
		Linear AlgebraII	2																	
		Seminar in Basic Mathematics I	1																	
		Seminar in Basic Mathematics II	1																	
		General Mechanics I	2																	
		General Mechanics II	2																	
		Experimental Methods and Laboratory Work in Physics I Note 4	1																	
		Experimental Methods and Laboratory Work in Physics II Note 4	1																	
	6	From all Subject Type Note 5		Free elective																
	48																			

Cluster 2 Basic Specialized Subjects

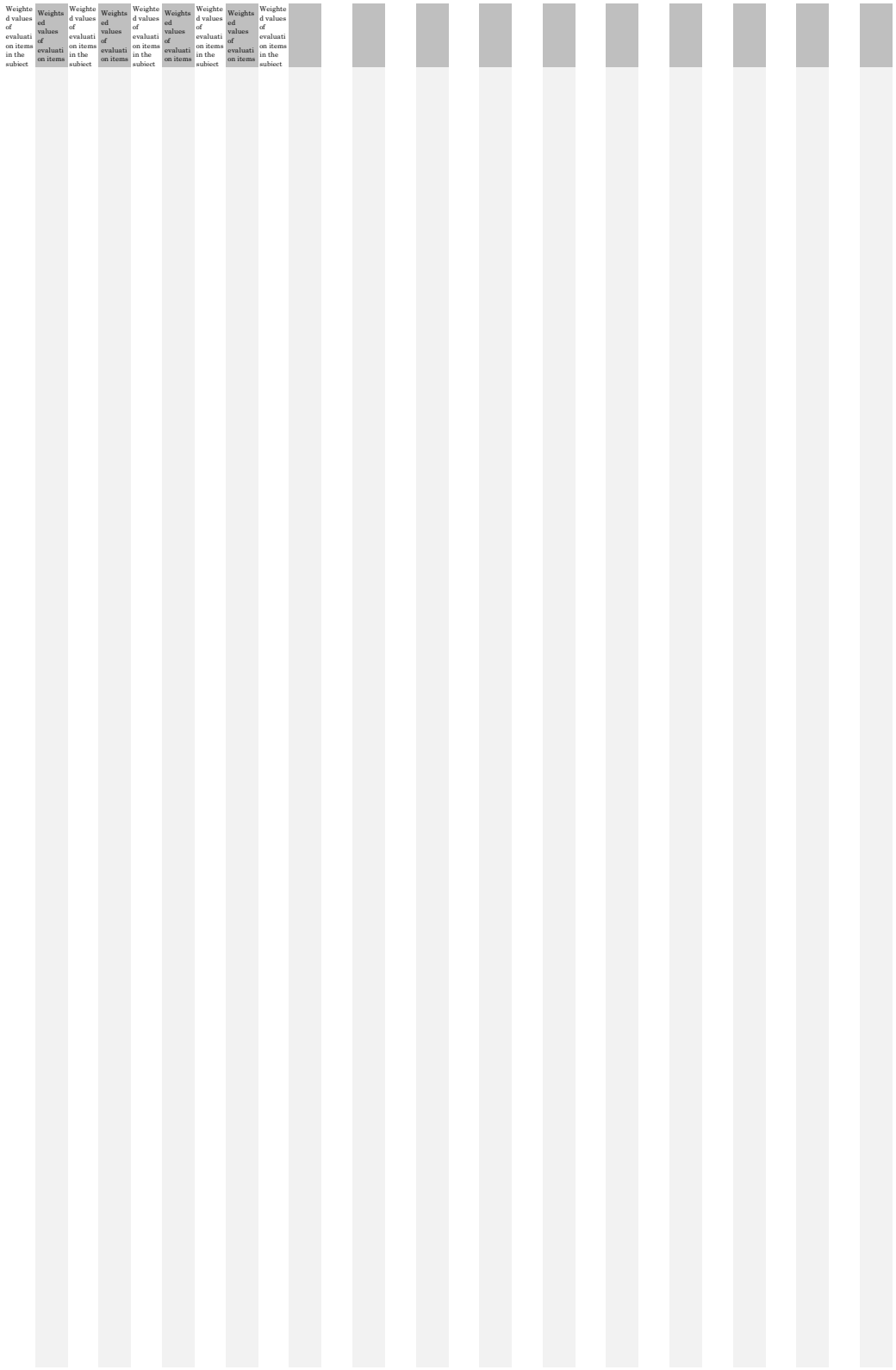
◎ Required subject
○Compulsory elective subje
△Free elective subject

Class Subjects	Credits	Type of course registration		Class Hours/Week																Note
		Electrical, Systems and Information Engineering	Electronic Devices and Systems	1st grade				2nd grade				3rd grade				4th grade				
				Spring		Fall		Spring		Fall		Spring		Fall		Spring		Fall		
				1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	
Applied Mathematics I	2					4														
Applied Mathematics II	2	○						4												
Applied Mathematics III	2								4											
Discrete Mathematics I	2	○							4											(School of Informatics and Data Science)
Synthesis of Applied Mathematics	2	○	○							4										
Engineering Mathematics A	2											4								
Engineering Mathematics C	2		○								4									
Probability and Statistics	2							4												
Technical English	1													4						
Introduction to Energy and Information Systems	2						4													
Electric Circuit Theory I	2					4														
Programming I	2								4											
Programming II	2									4										
Programming III	2											4								
Basic Experiments in Electrical Engineering I	2							5	5											
Basic Experiments in Electrical Engineering II	2									5	5									
Experiments in Electrical Engineering Electronics and System Engineering I	2											5	5							
Experiments in Electrical Engineering Electronics and System Engineering II	2													5	5					

Academic Achievements			Evaluation Criteria		
Evaluation Items					
Knowledge/Understanding					
Abilities/Skills					

Liberal Arts Education in this program assumes the role of establishing the academic foundation on which the specialized education for Cluster 2 in the School of Engineering is built. It fosters a willing, self-reliant attitude and cultivates scientific thinking based on data gathering ability, analytical ability, and critical thinking ability. It establishes an outlook that makes it possible to provide insight on the inner nature of things and their background from a broad perspective, and enhances linguistic ability to a level appropriate for living as a world citizen, and also strengthens interest in peace and the ability integrates a broad range of knowledge into a body of knowledge that will be truly useful in solving problems. It cultivates the ability to explore and promote cross-disciplinary and comprehensive research that goes beyond the established frameworks.

Relationships between the evaluation items and class subjects



Sheet

Curriculum Map of Electronic Devices and Systems

Academic Achievement	1st grade		2nd grade		3rd grade		4th grade	
Evaluation Items	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Knowledg/Understanding: The ethics and understanding about the relations between society and technology considered basically necessary for engineers.	<1T>Introduction to University Education Introduction to Information and Data Sciences	<1T>Introduction to Energy and Information Systems						
Knowledg/Understanding: Basic knowledge of mathematics such as calculus and linear algebra, which is required for scientists/engineers.	CalculusI Linear AlgebraI Seminar in Basic Mathematics I General Mechanics I	CalculusII Linear AlgebraII Seminar in Basic Mathematics II General Mechanics II Experimental Methods and Laboratory Work in Physics I						
		<1T>Introduction to Energy and Information Systems Electric Circuit Theory I						
		Applied Mathematics I	Applied Mathematics II Applied Mathematics III Probability and Statistics	Synthesis of Applied Mathematics Engineering Mathematics C				
			Programming I Electromagnetism I Exercise of Electromagnetism I Introduction to Physical Electronics Introduction to Semiconductor Devices and Circuits <1T>Logic System Design Circuit Theory II Control Systems Engineering I	Programming II Electromagnetism II Exercise of Electromagnetism II Quantum Mechanics Solid State Physics Electric Transient Phenomena Electronic Circuits Control Systems Engineering II <3T>Digital Circuit Design <3T>Algorithms and Data Structures	Thermodynamics and Statistical Mechanics Solid State Physics Signal Processing Engineering Electromagnetic Wave Propagation Semiconductor Device Engineering Electric and Electronic Measurements CMOS Logic Circuit Design Fundamentals of Power Systems Signal Processing Engineering Bioelectrical Engineering	Robotics Surface Science and Nanotechnology Optoelectronic Semiconductor Devices Electronic Material Engineering Semiconductor Process Engineering CMOS Integrated Design Communication Engineering <4T>Computer Network <4T>Human Computer Interaction		
			Exercise of Electromagnetism I <1T>Logic System Design Circuit Theory II Control Systems Engineering I Basic Experiments in Electrical Engineering I	Electromagnetism II Exercise of Electromagnetism II Electric Transient Phenomena Electronic Circuits Electric Energy Generation and Conversion Control Systems Engineering II <3T>Digital Circuit Design <3T>Algorithms and Data Structures Basic Experiments in Electrical Engineering II	Electromagnetic Wave Propagation Semiconductor Device Engineering Electric and Electronic Measurements CMOS Logic Circuit Design Fundamentals of Power Systems Signal Processing Engineering Bioelectrical Engineering <4T>Mechanism how programs run on computers Experiments in Electrical Engineering Electronics and System Engineering I	Surface Science and Nanotechnology Optoelectronic Semiconductor Devices Electronic Material Engineering Semiconductor Process Engineering CMOS Integrated Design Communication Engineering <4T>Computer Network <4T>Human Computer Interaction Experiments in Electrical Engineering Electronics and System Engineering II		
			Programming I	Programming II				
							Graduation Thesis	Graduation Thesis
	Introductory Seminar for First-Year Students						Graduation Thesis	Graduation Thesis
	Introductory Seminar for First-Year Students						Graduation Thesis	Graduation Thesis
			Basic Experiments in Electrical Engineering I	Basic Experiments in Electrical Engineering II	Experiments in Electrical Engineering Electronics and System Engineering I	Experiments in Electrical Engineering Electronics and System Engineering II		
	<1T>Introduction to University Education Peace Science Courses Area Courses Health and Sports Courses Basic language I II Basic English UsageI CommunicationI Communication I	Area Courses Health and Sports Courses Basic English UsageII Communication II Communication II				Technical English	Graduation Thesis	Graduation Thesis
Ex					Liberal Arts Education	Basic Specialized Subjects	Specialized Subjects	Graduation Thesis